

## Patent claims

1. Process for the production of unsaturated hydrocarbons, with the following layout:
  - In a first step hydrocarbon, in particular a mixture containing alkanes, which  
5 may have a water vapour content but which is essentially free from oxygen,  
penetrates in a continuous stream through a first catalyst bed, the latter  
exhibiting the standard dehydration conditions;
  - subsequently the reaction mixture obtained in the first step is mixed with liquid  
phase water and water vapour as well as with an oxygen-bearing gas;
  - 10 • and then the reaction mixture is fed in a continuous stream to a further catalyst  
bed as second step in which hydrogen oxidation and further dehydration of the  
hydrocarbons take place.
2. Process according to claim 1,  
15 **characterised in that** the first catalyst bed is heated and the heating of the first  
step is preferably adjusted in such a manner that an essentially isothermal  
operating mode is obtained.
3. Process according to any of the preceding claims 1 or 2,  
20 **characterised in that** oxygen-bearing gas is added to the reaction mixture  
produced in the second step and the reaction mixture thus obtained flows in a  
continuous stream through a further catalyst bed in at least a third step.
4. Process according to any of the preceding claims 1 to 3,  
25 **characterised in that** the reaction mixture is cooled in a cooling unit downstream  
of the second step prior to entering a further catalyst bed in a third process step.
5. Process according to any of the preceding claims 1 to 4,  
30 **characterised in that** the catalyst bed of the first step uses any standard  
commercial dehydration catalyst and the second and any further catalyst bed are  
provided with dehydration catalysts that exhibit not only dehydration activity but  
also SHC activity.

6. Process according to any of the preceding claims 1 to 5,  
**characterised in that** any of the process steps, particularly the second and further steps, is equipped with a catalyst that contains Pt and Sn applied to a carrier element essentially contains aluminate, in particular Zn aluminate.

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7. Process according to any of the preceding claims 1 to 6,  
**characterised in that** the second and any further step are provided with a specialist catalyst for water oxidation, hence a catalyst that improves the selectivity compared to that of standard dehydration catalysts when it comes to hydrogen oxidation, the said specialist catalysts being employed in combination with standard dehydration catalysts.

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8. Process according to any of the preceding claims 1 to 7,  
**characterised in that** the oxygen-bearing gas is oxygen-rich air.

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9. Process according to any of the preceding claims 1 to 8,  
**characterised in that** the quantity of oxygen-bearing gas added in the second and further steps is controlled via the temperature measured at the outlet of the respective upstream catalyst bed or via the outlet temperature of the last catalyst bed.

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